

## ABSTRACT

Described herein are integrated systems for generating neutrons to perform a variety of tasks including: on-line analysis of bulk material and industrial process control (as shown in Figure 1), security interrogation (as shown in Figure 2), soil and environmental analysis, and medical diagnostic treatment. These systems are based on novel gas-target neutron generation which embodies the beneficial characteristics of replenishable fusible gas targets for very long lifetime, stability and continuous operation, combined with the advantageous features common to conventional accelerator neutron tubes including: on/off operation, hermetically sealed operation, and safe storage and transport. Innovative electron management techniques provide gas-target neutron production efficiencies that are comparable or surpass existing sources. The high-pressure high-resistance gaseous discharge is presented as a favorable gas-target neutron generator embodiment, combining ion source regions, accelerator regions, gas-target regions and electron management components within a single simple cost-effective device that is adaptable to various geometric configurations that provide specific neutron emission profiles for greater analysis capacity.

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